

Christine Blondel, *Ampère et la création de l'électrodynamique (1820-1827)*, Paris (Bibliothèque Nationale) 1982, 202 pp., 175 frs. (*Mémoires de la Section des Sciences*, 10).

Based on a thorough study of all the extant source material, published articles and notices several of which have remained unnoted, as well as the large body of manuscripts in the archives of the *Académie des Sciences*, this book presents the first comprehensive analysis of Ampère's electrodynamic *oeuvre*. Such an analysis has long been overdue, and it has several important consequences.

The most important result, rightfully emphasized by the author, is a more detailed understanding of Ampère's microscopic speculations, outlined many years ago by L. Pearce Williams. Ampère regarded Fresnel's luminiferous ether as a neutral combination of the two electrical fluids. Although in his mathematical theory he described an electric current as a steady flow of electricity, its intensity to be measured by its electromagnetic action, he really believed it to consist in a series of decompositions and recombinations of the two fluids. These processes would set up vibrational processes in the ether. In this way Ampère's fundamental electrodynamic force between current elements, described mathemat-

ically by the famous force law, would be explained by an influence propagating through the ether. Ampère hoped that the development of continuum mechanics, initiated by Fresnel and Cauchy, would eventually lead to a unified account of a propagation of light, radiant heat, and electrodynamic force. Blondel shows how Ampère on several occasions justified assumptions about electrodynamic forces, such as the principle of superposition and the equality of action and reaction, by referring to mechanical properties of the ether. She also reprints an essay, written by Ampère around 1824 but only printed by Abbé Moigno in 1849, in which Ampère combined these ideas with an electrochemical theory similar to that advanced by Grotthuss and, strangely enough, with the contact theory of the Voltaic pile.

Ampère's adherence to the contact theory also influenced a different part of his work. Thus, while he correctly interpreted Faraday's and his own discoveries of various types of electromagnetic rotations as demonstrating a continuous production of *vis viva*, and therefore as the death blow to any theory based on static distributions of magnetic fluids, it does not seem to have occurred to him, as it did to Joule twenty years later, that this gain might be paid for by chemical losses in the pile. As Blondel shows, Ampère's description clearly indicated that although he refrained from using the objectionable term explicitly, he in fact regarded an electromagnetic rotation apparatus as a kind of *perpetuum mobile*, and a Voltaic pile as an inexhaustible source of mechanical power.

The book also clarifies our picture of Ampère as an experimental physicist. Blondel shows, convincingly, how in the early phase Ampère used qualitative experiments to discover new phenomena whose existence he was sometimes able to predict from his theoretical conceptions, while later on experiments, often rather intricate ones, served as quantitative confirmation of the mathematical theory. On

several occasions, as with two of the famous null experiments, the mere engraving of a detailed piece of equipment never constructed, or if constructed, not successfully functioning, served as part of Ampère's argumentation. Blondel characterizes Ampère as having great talents for inventing and designing new types of experimental devices, combined with a notorious clumsiness in manipulating his own instruments.

Blondel's book is very rich in information and new insight, and it represents a substantial addition to our knowledge and understanding of Ampère's work. It does take some effort on the part of the reader, however. Almost all the illustrations are reprints of Ampère's original engravings which are unusually difficult to penetrate. The few diagrams provided by the author herself are such a great help that one would have wished for many more of these to elucidate the engravings.

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